

WE CLAIM:

1. A magnetic read head, comprising an ALD-formed head gap fill layer selected from the group consisting of aluminum oxide, aluminum nitride, mixtures thereof and layered structures thereof.
2. The magnetic read head of Claim 1 wherein the ALD-formed head gap fill layer has a thickness of between approximately 5 nm and 100 nm.
3. The magnetic read head of Claim 1 wherein the ALD-formed head gap fill layer has a thickness of between approximately 10 nm and 40 nm.
4. The magnetic read head of Claim 1 wherein the ALD-formed head gap fill layer has a thickness variation of less than about 2%.
5. The magnetic read head of Claim 1 wherein the ALD-formed head gap fill layer overlies a magnetic shield layer.
6. The magnetic read head of Claim 5 wherein the magnetic shield layer comprises nickel-iron.
7. The magnetic read head of Claim 1 wherein the ALD-formed head gap fill layer overlies a barrier layer.
8. The magnetic read head of Claim 7 wherein the barrier layer comprises tantalum.
9. The magnetic read head of Claim 1 comprising a magnetic sensing element selected from the group consisting of GMR (giant magnetoresistive), CMR (colossal magnetoresistive) and TMR (tunneling magnetoresistive) sensors.
10. The magnetic read head of Claim 1 wherein the magnetic read head comprises a spin valve structure.
11. A magnetic read head gap fill material, comprising a structure of aluminum oxide mixed with a compound with a higher thermal conductivity than aluminum oxide.
12. The gap fill material of Claim 11 wherein the compound with high thermal conductivity is selected from the group consisting of beryllium oxide and boron nitride.
13. The gap fill material of Claim 11 wherein the structure comprises alternated layers of aluminum oxide and the compound with a higher thermal conductivity.

14. A magnetic read head with a head gap fill layer comprising aluminum, oxygen and nitrogen, the head gap fill layer having an as-deposited thickness variation of less than about 2%.

15. The magnetic read head of Claim 14 wherein the gap fill layer comprises  $\text{Al}_2\text{O}_3$  and  $\text{AlN}$  phases.

16. The magnetic read head of Claim 14 wherein the gap fill layer comprises  $\text{Al}_2\text{O}_3$  and  $\text{AlN}$  layers.

17. The magnetic read head of Claim 14 wherein the gap fill layer comprises the ternary phase,  $\text{Al}_x\text{O}_y\text{N}_z$ .